Golden Valley Cooperative Project in Alaska - 40 MW Nickel-Cadmium Battery

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"Meeting California's Electricity System Challenges through Electricity Energy Storage"

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EPRI

Golden Valley Electric Association (GVEA)

- GVEA headquarters in Fairbanks, Alaska
  - Rural cooperative serving over 90,000 residents
  - Winter temperature of -50ºC
- Peak system demand ~180 MW
- 2882 miles of T&D lines over 5700 square miles
- Power supplies:
  - "Local" generation (225 MW)
  - 400-mile transmission line from Anchorage (80 MW)

Photo credit: Golden Valley Electric Association

The Need: Reliable Power

- Fairbanks dependent on low-cost power from Anchorage
  - Single, 400-mile transmission line
- "Island system" prone to outage-induced instability
  - Line outage → 7 Hz/s frequency decay
  - Anchorage generator outage → 1.5 Hz/s decay
- Traditional means of improving stability
  - Additional transmission lines
  - Additional generation
- Means in use prior to BESS
  - Local "spinning" reserve
  - Customer load shedding ("SILOS")

The Solution: New Transmission + Battery Storage

- Northern Intertie Project
  - New 60-mile, 230 kV transmission line
  - Parallels to existing 138 kV line, providing redundancy
  - Healy coal plant to Fairbanks
  - Requires reactive compensation

Photo credit: Golden Valley Electric Association

The Solution: New Transmission + Battery Storage

- Battery Energy Storage System (“B.E.S.S.”)
  - Installed at northern terminus of the Northern Intertie
  - 40 MVA, 15-minute battery storage system
  - Multiple operating modes

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BESS Project Information

- Owner and operator
  - Golden Valley Electric Association
- Major equipment and construction
  - ABB: Prime contractor: power converter, primary design and controls engineering
  - Saft: Battery supplier (“cradle to grave”)
  - City Electric: General contractor
- Project schedule: 24 months
  - Ground break to final test
- Project cost: $35M
  - ABB consortium, ~$31M
  - Local construction, ~$4M

System Description - Battery

- Saft nickel-cadmium pocket plate battery
- 27 MW for 15 minutes (40 MW with 6 strings)
- 4 electrical strings (expandable to 8)
- 3440 high rate cells per string (13,760 total)
- 1,376 ten-cell forkliftable modules
- Automatic watering system
- Battery room: 120 m X 26 m
- Total weight: 1,500 tons
- Life: 20 - 30 years

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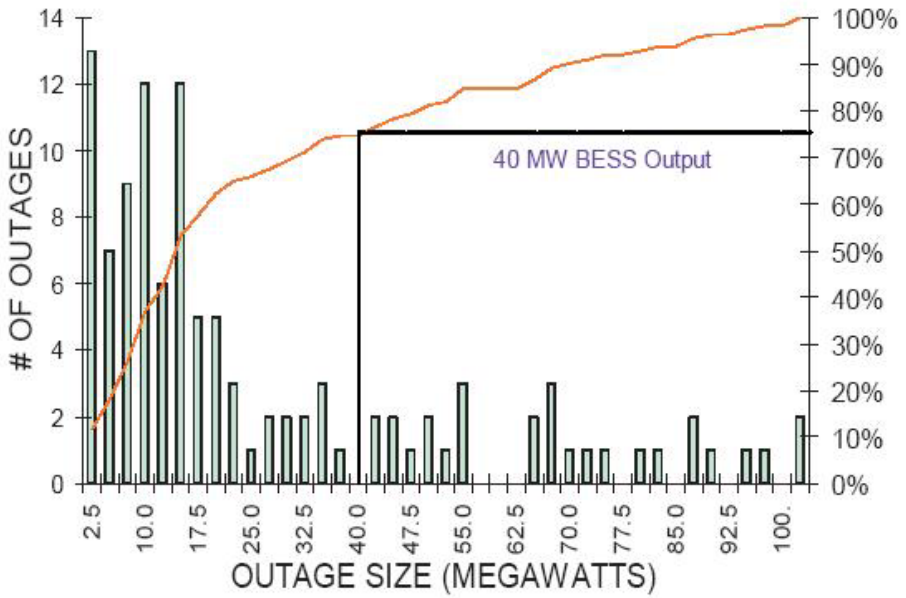
System Description - PCS

- ABB IGCT-based power conversion system
- 40 MVA rated (46 MVA maximum) power
- Dual 20 MVA modules, three-level inverter design
- 5 kV DC link (+/- 2500 volts dc)
- 138 kV AC output transformer
- Water-cooled

Photo credit: Patrick J. Endres / Alaskaphotographics.com

BESS Operating Modes & Priority

1. Spinning Reserve
2. Automatic Scheduling
3. Support for Scheduled Load Increases
4. Automatic Generator Control (AGC)
5. VAR Support
6. Power System Stabilization (PSS)
7. Charging



Graphic credit: Golden Valley Electric Association

BESS Operating Modes In Use To Date

- Spinning reserve (SR)
  - 60 events thru 12/2004
  - Average power = 12 MW
  - 553 cumulative minutes
  - 297,720 cumulative no. of customers protected
- Automatic generation control (AGC)
- VAR-support
  - 5 to 7 MVAR, continuously
- Power system stabilization
  - As much as +/- 5 MW above SR discharge
  - Primarily occurs immediately after outage disturbance

Performance to Date

- Availability since startup > 99%
  - System has been down only 5 days in 17 months!
  - 18-month acceptance requires >98% (11 days)
- Power performance exceeded specifications
  - 27 MW for 24 minutes, with 2 of 4 strings
- Reduction in power supply outages exceeded
  - Planned 60 – 65%
  - Achieved 80% to date!

GV BESS: “Firsts” and World Records

- First commercial utility battery facility to be bid, procured and installed using turn-key system RFP
  - Specification developed by EPRI and used by GVEA
- Highest voltage battery in world
  - > 5,200 Vdc
- Most powerful battery in world
  - 46 MW for 5 minutes
- (SCE/ILZRO/EPRI Chino Battery still the largest capacity battery in the U.S., at 40 MWh)